

Hydrogen-Based Energy Conservation System, Phase I

Completed Technology Project (2012 - 2013)



Project Introduction

NASA and many others often rely on delivery of cryogenic hydrogen to meet their facility needs. NASA's Stennis Space Center is one of the largest users of hydrogen, with the LH2 used as a fuel for cryogenic rocket engine testing. Other NASA centers including Kennedy Space Center, which utilizes hydrogen to support space shuttle launches, and many industrial locations also use significant amounts of hydrogen. Unfortunately extremely large amounts of hydrogen are lost during transfers and test operations due to boil-off resulting from heat transferred into the equipment, or by other means. Additionally, through test operations, hydrogen and helium become mixed and require separation to regain their value. This gaseous hydrogen is typically flared as a safety measure with little to no economic value or energy efficiency realized from the process. No economical means exists to safely capture, process and store, and simultaneously extract valuable energy, the large amounts of gaseous hydrogen released during NASA test operations, or in industrial applications where cryogenic hydrogen is used. The technologies developed to capture and clean the hydrogen must be cost effective and able to perform the recycling process in an in-situ rocket engine test area environment, and must comply with all safety and quality standards for this environment. Because cryogenic hydrogen is very pure, its recycle and recovery as a compressed gas can result in a valuable commodity and can provide the basis of a power generation system that conserves facility energy. This STTR project develops a Hydrogen-Based Energy Conservation System (HECS) that brings in gaseous hydrogen released from cryogenic storage or transfer or mixed hydrogen, helium stream from test operations, purifies the hydrogen and alternately electrochemically compresses it to commercial storage pressures (up to 6,000 psi) and reuses the hydrogen in a reaction with air to efficiently produce electricity.



Hydrogen-Based Energy
Conservation System, Phase I

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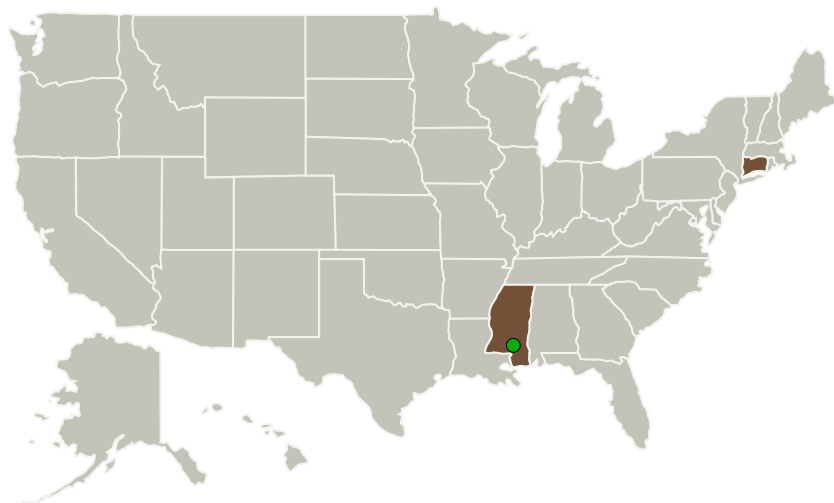
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Sustainable Innovations, LLC	Lead Organization	Industry	East Hartford, Connecticut
Skyre Inc	Supporting Organization	Industry Small Disadvantaged Business (SDB)	
● Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
University of Connecticut	Supporting Organization	Academia	Storrs, Connecticut

Primary U.S. Work Locations

Connecticut	Mississippi
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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sustainable Innovations, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Trent Molter

Co-Investigator:

Trent Molter

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Project Transitions

 **February 2012:** Project Start

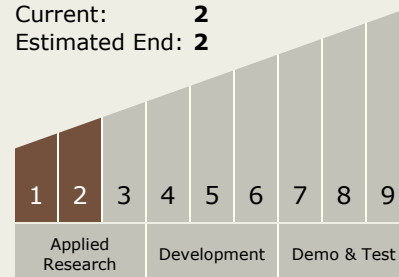
 **February 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140344>)

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX13 Ground, Test, and Surface Systems
 - TX13.1 Infrastructure Optimization
 - TX13.1.3 Commodity Recovery

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System